

<i>termvar</i> , x	term variable
<i>typevar</i> , X, Y, Z	type variable
<i>string</i> , s	strings
<i>integer</i> , i	integers
<i>double</i> , d	doubles
<i>expr</i> , <i>lexpr</i>	place holders for labels and quantitative expressions
<i>index</i> , j	

$quant, Q$	$::=$ $ \quad Q \rightarrow Q'$ $ \quad \text{Double}$	quantitative types
$numop, \text{op}$	$::=$ $ \quad +$ $ \quad -$ $ \quad *$ $ \quad /$	numeric operations
$qexpr, q$	$::=$ $ \quad x$ $ \quad \lambda x. q$ $ \quad q_1 \ q_2$ $ \quad q_1 \text{ op } q_2$ $ \quad \text{rec } q_0 \text{ of } q_1 q_2$ $ \quad d$	quantitative expressions
$labelTy, L$	$::=$ $ \quad \text{String}$ $ \quad \text{Double}$	
$label, l$	$::=$ $ \quad d$ $ \quad s$	all doubles all strings
$atreeStruct, A, B, C, R, S, T$	$::=$ $ \quad X$ $ \quad A \sqcup B$ $ \quad A \otimes B$ $ \quad A \odot B$ $ \quad A \triangleright B$	attack tree structure nodes of the tree choice interacting parallel composition non-interacting parallel composition sequencing
$kinds, k$	$::=$ $ \quad \text{AttackTree } L \ Q$ $ \quad k_1 \rightarrow k_2$	kinds
$comb, c$	$::=$ $ \quad \sqcup$ $ \quad \otimes$ $ \quad \odot$ $ \quad \triangleright$	attack tree combinators
$atree, t$	$::=$ $ \quad x$ $ \quad \lambda x. t$ $ \quad t_1 \ t_2$	attack tree expressions

$$\begin{array}{|l} \text{leaf } l \ q \\ c \ l \ q \end{array}$$

$\Gamma ::=$ kinding context

$$\begin{array}{|l} \cdot \\ x : k \\ \Gamma_1, \Gamma_2 \end{array}$$

$\Delta ::=$ quant context

$$\begin{array}{|l} \cdot \\ x : Q \\ \Delta_0, \Delta_1 \end{array}$$

$\boxed{\vdash l : L}$

$$\frac{}{\vdash d : \text{Double}} \quad \text{L_DOUBLE}$$

$$\frac{}{\vdash s : \text{String}} \quad \text{L_STRING}$$

$\boxed{\Delta \vdash q : Q}$

$$\frac{}{\Delta_0, x : Q, \Delta_1 \vdash x : Q} \quad \text{Q_VAR}$$

$$\frac{}{\Delta \vdash d : \text{Double}} \quad \text{Q_DOUBLE}$$

$$\frac{\Delta, x : Q_0 \vdash q : Q_1}{\Delta \vdash \lambda x. q : Q_0 \rightarrow Q_1} \quad \text{Q_FUN}$$

$$\frac{\Delta \vdash q_1 : Q_0 \quad \Delta \vdash q_0 : Q_0 \rightarrow Q_1}{\Delta \vdash q_0 \ q_1 : Q_1} \quad \text{Q_APP}$$

$$\frac{\Delta \vdash q_1 : \text{Double} \quad \Delta \vdash q_2 : \text{Double}}{\Delta \vdash q_1 \text{ op } q_2 : \text{Double}} \quad \text{Q_NOP}$$

$$\frac{\Delta \vdash q_0 : \text{Double} \quad \Delta \vdash q_1 : Q \quad \Delta \vdash q_2 : Q \rightarrow Q}{\Delta \vdash \text{rec } q_0 \text{ of } q_1 | q_2 : Q} \quad \text{Q_REC}$$

$\boxed{\Gamma \vdash t : k}$

$$\frac{}{\Gamma_0, x : k, \Gamma_1 \vdash x : k} \quad \text{K_VAR}$$

$$\frac{\Gamma, x : k_0 \vdash t : k_1}{\Gamma \vdash \lambda x. t : k_0 \rightarrow k_1} \quad \text{K_FUN}$$

$$\frac{\Gamma \vdash t_1 : k_0 \quad \Gamma \vdash t_0 : k_0 \rightarrow k_1}{\Gamma \vdash t_0 \ t_1 : k_1} \quad \text{K_APP}$$

$$\frac{\vdash l : L \quad \cdot \vdash q : Q}{\Gamma \vdash \text{leaf } l \ q : \text{AttackTree } L \ Q} \quad \text{K_LEAF}$$

$$\frac{\vdash l : L \quad \cdot \vdash q : Q \rightarrow Q \rightarrow Q}{\Gamma \vdash c \ l \ q : \text{AttackTree } L \ Q \rightarrow \text{AttackTree } L \ Q \rightarrow \text{AttackTree } L \ Q} \quad \text{K_COMB}$$

Definition rules: 13 good 0 bad
Definition rule clauses: 21 good 0 bad